



NASA Langley's Integrated Universal Chemical Detector with Selective Diffraction Array

Chemical detector array produces unique diffraction pattern for any combination of chemicals detected

NASA Langley researchers have developed a universal chemical detector based on optical detection methods. Optical chemical detection is commonplace, from swimming pool test strips to at-home pregnancy tests, and is based on the optical changes of the detector after contact with a target chemical. Such detectors are large in size so as to be readable by the human eye. The innovation described here provides a method by which a microscale array of such optically sensitive detectors can be used to detect a variety of chemicals, or chemical combinations, simply based on the unique optical diffraction pattern obtained from the sensor array after exposure to any combination of different target chemicals. This detector arrangement thus provides a convenient method to miniaturize the optical detection and yet easily read the output of an array of such detectors. An array on the order of millimeters in size can now detect tens or hundreds of chemicals, not just one or a few.

Benefits

- Multi-measurement capability – detector array can be designed to detect a large number of chemicals independently or in combination
- Detector read-out is based on simple laser illumination of array, and image can be captured via CMOS or CCD image sensors
- Detection can be in gas or liquid state
- Simple analysis of diffraction pattern can be easily performed based on comparison against diffraction pattern database
- Simple to manufacture – array can be mass produced by affixing reactants to array via screen printing, lithography, stamping, or similar methods
- Small size – detector on the order of 1 x 1 cm can have hundreds or thousands of pixels
- Patent application filed

partnership opportunity



Applications

The technology offers wide-ranging market applications, including:

- Biotoxin detection in food processing
- Homeland security
- Environmental protection and monitoring
- Chemical processing and safety
- Biomedical services

The Technology

The technology is based on simple optical detection via change in optical properties of reactants when exposed to target chemicals. For example, reactants can change refractive index, color, or transparency when exposed to a target chemical. The NASA detector array technology employs a large number of such detectors arranged systematically on the microscale into a detector array. Thus, depending on the chemical or chemical mixture detected by the array, a unique pattern is created in the spatial distribution of the optical condition of each individual detector across the array. This pattern creates a unique diffraction pattern under illumination by a laser light source. The diffraction pattern is easily read via standard CMOS or CCD image sensors and then analyzed against pre-established diffraction patterns in database for the various possible combinations to provide rapid analysis of the entire detector array at one time. Reactants with changing optical properties are well known within the industry and are widely available for a number of chemicals.

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

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LAR-17416-1